ANALYSES

OF THE

Hydrant and Well Waters of the City of Troy,

PRESENTED TO THE

BOARD OF HEALTH

FOR THE YEAR ENDING MARCH 1ST, 1858,

BY PROF. WM. ELDERHORST.

Members of Common Council.

LYMAN R. AVERY, *President.*
MARTIN I. TOWNSEND, *Secretary*
JOHN M. BOGARDUS,
LEONARD SMITH,
ANGUS CAMPBELL.

Ass't City Commissioners.

Health Inspectors
WILLIAM CUTTER,
WILLIAM BIGGART.

WITH REPORT OF HEALTH OFFICER ON THE SAME.

PRINTED BY ORDER OF THE BOARD.

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Gentlemen:—Members of the Board of Health:

In accordance with a resolution passed by the Board, I submit the following Report of Prof. Elderhorst on the chemical characters of the Hydrant water and of two of the most popular city wells, with such observations as have the most important bearing upon their respective value for domestic purposes; and are, in my judgment, best calculated to call the attention of the public at large to the great difference in their purity and healthfulness. The examination of the hydrant water was made in July 1856, by order of the Board of Health of that year. It was at first contemplated to make a more extended examination, by subjecting the water to analysis during different seasons of the year and at different points of its course.

The Board of Health, however, was unwilling to take the responsibility of the additional expenditure, and, on referring the matter to the Common Council, that honorable body thought the information already obtained amply sufficient for all practical purposes, and declined authorising a continuance of the investigation.

It may be questioned whether it would not have been wiser to analyze at least the springs from which by far the largest portion of the water consumed is derived; as such analysis might have shown a degree of additional purity at the source, which would have suggested and justified, at some future day, the conveyance of the water directly from the fountain head, thereby rejecting the contributions, superficial, alluvial, and pastureal, which it is suspected of receiving in its course.

Be that as it may, the examination so far as carried was thorough and satisfactory, and it pleased the Board of the current year to order the analysis of two, of the city wells, that citizens and the hydrant water might have the benefit of a comparison. The number being limited to two it was natural and seemed most proper that those should be selected in which the largest number of consumers are most interested, and hence the selection of the wells at the junction of North Second and Jacob, and at the corner of Fourth and Ferry Streets, though it is very much doubted whether they are not among the most favorable, if not the most favorable specimens of their class.

L. R. AVERY, ESQ.,

Chairman of the Board of Health.

SIR:

In compliance with the wishes of the Board of Health, I have instituted a chemical examination of the hydrant water, and of the water of the two wells, corner North Second and Jacob Streets, and corner Third and Ferry-sts.

Having completed the analyses, I beg to submit to the Board the following results:

ERRATA.

Page 19, line 16 from top, read affections for 'afflictions.'

Page 19, line 10 from bottom, read those for 'these.'

Page 25, line 21 from top, read derangements for 'arrangements.'

Page 26, line 15 from bottom, read pure for 'poor.'

Page 31, line 7 from bottom, read vesical for 'versical.'

Page 31, last line, read loved for 'lived.'

In tables on page 28, read Lambeth *and* Southwork, Southwork *and* Kent, instead of '*of*,' &c.

EXAMINATION OF THE HYDRANT WATER.

The specimens of water which I operated upon, were collected in the last days of July, 1856. The fall of rain during the preceeding days of the month, had been as follows:

Fall of rain on the	3d	of	July,	amounted to	0.69 inches.*
" "	4th	"	"	0.06	"
" "	8th	"	"	0.04	"
" "	9th	"	"	0.02	"
" "	12th	"	"	0.86	"
" "	15th	"	"	0.04	"
" "	21st	"	"	0.01	"
" "	22nd	"	"	0.02	"

This amount of rain is smaller than that of the months of June, May, and April, of the same, or any of the preceeding six years, whence we may infer that the water chosen for examination was in a state of considerable concentration, or, in other words, that, under ordinary circumstances, it will contain less fixed matter than found by the subjoined analyses:

Samples of the water were taken from the following localities:

The specimen, marked A, was taken on the 30th of July, from the reservoir, at the south end of the arch, very near the point where the main pipe runs off.

The specimen, marked B, was taken on the 31st of July, from a pipe near the hospital, foot of Fourth Street. At this point one of the iron main pipes terminates, and the sample of water taken from this spot may be considered as in a state of maximum impurity.

*These dates I owe to the kindness of Dr. T. W. Blatchford, from whose register they have been taken.

The specimen, marked C, was taken on the 29th of July, from the hydrant of the chemical laboratory, in the second story of the Academy building, on State Street.

The specimen, marked D, was taken on the 30th of July, from the pond near the road leading to Oakwood Cemetery, above the reservoir.

A portion of the water C, was employed for a qualitative examination. 600*cc* were introduced into a flask, and reduced, by boiling, to about 300*cc*; the water became slightly turbid, but, by resting, clear again, the precipitate settling to the bottom and sides of the vessel. The liquid was separated from the precipitate by filtration, and the following tests applied to the filtrate:

It is perfectly neutral to test papers.

Chloride of barium gave, after a few minutes standing, a slight precipitate, which did not dissolve in hydrochloric acid—proving the presence of *sulphuric acid.*

Nitrate of silver gave a ready precipitate, which did not dissolve in nitric acid—indicating the presence of *chlorides.*

Oxalate of ammonia gave a precipitate soluble in hydrochloric acid, and insoluble in acetic acid—showing the presence of *lime.*

The filtrate from the last precipitate, upon the addition of ammonia and phosphate of soda, gave no precipitate.

The precipitate, which was deposited from the water on boiling, was dissolved in dilute hydrochloric acid. It dissolved perfectly, (with the exception of a little organic matter,) with effervescence—showing the presence of *carbonic acid.* The solution was tested with the following reagents:

Ferrocyanide of potassium imparted to the liquid a greenish blue color; after about sixteen hours resting, a very slight blue precipitate had formed—indicating the presence of *a trace of iron.*

Ammonia gave a very slight, flocculent precipitate, of dirty white color—showing the presence of *alumina* or *phosphate of lime,* tinged by iron.

The filtrate from the last precipitate, gave, with oxalate of ammonia, an abundant precipitate—indicating *lime.*

The filtrate from the last precipitate, upon the addition of ammonia and phosphate of soda, gave a crystalline precipitate —indicating the presence of *magnesia.*

By a separate experiment, executed in the manner described below, (see quantitative determination of the alkalies,) the presence of *soda* was shown.

All well and river waters contain a certain amount of organic matter. The quantity is usually too minute to exercise any injurious effect on the system, and in this case, also, its presence cannot be readily detected by means of the usual reagents; but if the quantity of organic substances increases, and especially of organic matter in a state of decomposition, it seriously influences the system, and becomes, at the same time, detectible through chemical reagents. I subjected the four different specimens of water to the test proposed by A. Dupasquier, (Ann. de Chim. et de Pharm., 3 ser., vol. xiii., p. 164-168,) which consists of heating the water to ebullition with addition of a few drops of a neutral solution of terchloride of gold. If the water contains not more than the usual amount of organic matter, the color of the liquid (a pale yellow,) is not perceptibly changed, but if much organic matter is present it changes, according to the proportion of the impurity, to brown, violet, blue. Since the presence of lime interferes with the result, it is necessary to add, after boiling, a few drops of hydrochloric acid, in case the water under trial should contain a salt of lime as a constituent. Of each of the waters A, B, C, and D, 50*cc.* were mixed with 15 drops of a solution of terchloride of gold, heated to ebullition for two minutes, allowed to cool, and a few drops of hydrochloric acid added. In the waters B and C I noticed a slight bluish tinge after ten minutes' resting, in A and D only after half an hour's resting; the tinge of B was deeper than that of C, of A deeper than D; so that with reference to their purity, dependent on the presence of organic matter in a state of decomposition, they range as follows: D (the purest,) A, C, B. In all these cases, however, the color was so slight, that I could only discover it by placing the liquids in long and narrow glass-tubes, and looking through the whole length of the tube against a sheet of white paper.

I would here, again, call attention to the fact that these specimens of water were collected after a long continued drought, and in the summer season, both of which circumstances favor, according to Forchhammer, the presence of organic matter in natural waters. This chemist found, by a series of observations, that the quantity of organic matter in water is greatest in summer, and disappears for the most part as soon as the water freezes, and is also diminished by rain.

The result of this examination, therefore, shows clearly that no objection whatever can be raised against the use of the hydrant water as far as its organic impurities are concerned.

Quantitative Analysis.

Quantitative analyses were made of the waters A and B. Before stating the analytical results, I shall give a short 'expose' of the method pursued.

The water was filtered, to free it from all mechanical impurities. The total amount of fixed ingredients was then determined by evaporating a certain volume, usually 300cc.,* to dryness over a water-bath; the residue was then dried in an air-bath at a temperature varying from 110° C. to 120° C., until the weight became constant; the weight having been ascertained, the capsule containing the residue was heated to a low redness until all the organic matter was destroyed; it was again weighed, and the difference between the first and the second operation expresses the amount of organic matter.

Another portion of the water is used for the determination of the chlorine, silicic acid, and the bases. The water is acidulated with a few drops of nitric acid, and evaporated to dryness; it is first heated over the flame of a spirit-lamp and finally in a sand-bath. The dry residue is digested with dilute nitric acid and the silica, which has become insoluble, collected on a filter, and weighed. The filtrate is precipitated by nitrate of silver, and thus the chlorine determined as chloride of silver. From the filtrate the excess of the silver is removed by hydrochloric acid. The filtrate is precipitated by ammonia, which throws down the iron, alumina, and phosphate of lime; they are col-

* 3785 cubic centimeters = 1 Gallon; 1 gramme = 15.434 grains.

lected on a filter, and weighed. The filtrate is precipitated by oxalate of ammonia, which throws down the lime; the oxalate of lime is collected on a filter, dried, and ignited; it is, thereby, converted into the carbonate, which is weighed. From the filtrate of the last operation the magnesia is precipitated by phosphate of soda.

A third portion of the water is concentrated by evaporation, acidulated with hydrochloric acid, and precipitated by chloride of barium; the precipitate, consisting of sulphate of baryta, is weighed and thus the amount of sulphuric acid determined.

A fourth portion of the water is concentrated by evaporation, mixed, while hot, with an excess of hydrate of baryta, filtered; from the filtrate the excess of baryta is removed by a mixture of ammonia and carbonate of ammonia; the filtrate from this operation is neutralized with hydrochloric acid, evaporated to dryness, ignited; the residue is mixed with a little water and pure oxide of mercury, evaporated to dryness, and ignited; the residue is treated with hot water, filtered, and the filtrate evaporated to dryness; the residue consists of alkaline chlorides.

Operating in the manner just described, the following results were obtained:

ANALYSIS OF WATER A.

	Grammes.
I. 300*cc.* evaporated to dryness over a water-bath, gave, of total residue,.....	0.0381
The residue upon ignition, lost,.....	0.0072
II. 2500*cc.* gave, of silica,.....	0.0147
" " of chloride of silver,.....	0.0055
=0.00136 grammes chlorine.	
" " of alumina and phosphate of lime, with a trace of iron,.....	0.0062
" " of carbonate of lime,.....	0.1984
=0.1111 grammes of lime.	
" " of phosphate of magnesia,.....	0.0326
=0.01188 grammes of magnesia.	

III. 1000*cc.* gave, of sulphate of baryta,..... 0.0239
=0.0082 of sulphuric acid.

IV. 1000*cc.* gave, of chloride of sodium,*..... 0.0102
=0.004 grammes of sodium.

On calculating the several numbers thus obtained for equal volumes of water, most conveniently for 3785*cc.*=1 gallon, and converting the French grammes into English grains, we obtain the following values for the single ingredients:

	Grains.
Total residue,.....	7.4376
Organic matter,.....	1.4014
Leaving of fixed residue,.....	6.0362
Chlorine,.....	0.0318
Sulphuric acid,.....	0.4785
Silica,.....	0.3434
Alumina and phosphate of lime,†.....	0.1447
Lime,.....	2.5962
Magnesia,.....	0.2762
Sodium,.....	0.2392

ANALYSIS OF WATER B.

Grammes.

I. 300*cc.* evaporated to dryness over a water-bath, gave, 0.0425
The residue upon ignition, lost,..... 0.0103

II. 3200*cc.* gave, of silica,..... 0.0184
" " of chloride of silver,..... 0.0023
=0.00057 grammes chlorine.
" " of alumina and phosphate of lime,†..... 0.0051
" " of carbonate of lime,..... 0.2240
=0.1254 grammes of lime.
" " of phosphate of magnesia,..... 0.0952
=0.0346 grammes of magnesia.

III. 1000*cc.* gave, of sulphate of baryta,..... 0.0230
=0.0079 grammes of sulphuric acid.

IV. 1000*cc.* gave, of chloride of sodium,..... 0.0110
=0.0043 grammes of sodium.

* Found, on examination, to be free from any perceptible quantity of chloride of potassium.

† With traces of sesquioxide of iron.

The respective amounts calculated for one gallon, and expressed in English grains, we have:

	Grains.
Total quantity of residue,	8.2755
Organic matter,	2.0000
Leaving of fixed residue,	6.2755
Chlorine,	0.0103
Sulphuric acid,	0.4615
Silica,	0.3358
Alumina and phosphate of lime,	0.0922
Lime,	2.2895
Magnesia,	0.6312
Sodium,	0.2469

ANALYSIS OF WATER C.

	Grammes.
300*cc.* evaporated to dryness over a water-bath, gave,	0.0390
The residue upon ignition, lost,	0.0055

Equivalent in a gallon to

	Grains.
Total quantity of residue,	7.5933
Organic matter,	1.0695
Leaving of fixed residue,	6.5238

The organic matter, occurring in spring water, exists usually in the shape of organic acids which are in combination with the alkalies. After evaporation and ignition the latter exist as equivalent carbonates. If there is not enough of the organic acids to combine with the whole of the alkalies, the excess is found in combination with chlorine. The sulphuric acid combines, by preference, with lime; the excess of the latter base exists as carbonate, as is also the case with the magnesia, none of this base having been found, as above stated, in the water after ebullition, but only in the precipitate. The lime and magnesia exist in the water, more properly speaking, as bicarbonates; on boiling, one equivalent of carbonic acid is driven out and the monocarbonates are precipitated.

According to this scheme, the composition of the inorganic residue of the above waters is as follows:

	In one gallon=3785cc. of Water A.	Water B.
	Grains.	*Grains.*
Chloride of sodium,.....	0.0524	0.0143
Carbonate of soda,.....	0.5037	0.6233
Carbonate of magnesia,.....	0.5800	0.9255
Carbonate of lime,.....	4.0380	3.5116
Sulphate of lime,.....	0.8134	0.7845
Silica,.....	0.3434	0.3358
Alumina and phosphate of lime, with traces of sesquioxide of iron,.....	0.1447	0.0922
	6.4756	6.2872
Organic matter,.....	1.4014	2.0000
Total of solid matter,.....	7.8770	8.2872
As determined directly,.....	7.4376	8.2755

A fair average composition of the water is probably obtained by taking the mean of the analyses of the three different specimens. Then we have in one gallon of

	Water A.	Water B.	Water C.	Mean.
Solid residue,.....	7.4376	8.2755	7.5933	7.7688
Inorganic,.....	6.0362	6.2755	6.5238	6.2785
Organic,.....	1.4014	2.0000	1.0695	1.4903

The following little table will show at a glance the value of the Reservoir water (water A,) compared with other waters in this country, used for the supplies of cities.

100000 parts of water contains:	Passaic.§	Schuylkill*	Croton.§	Cochituate*	Jamaica.§	Albany.§	Troy.
Solid residue	12.7500	9.4170	18.7100	5.3400	5.3560	18.4800	12.7434
Inorganic,..	7.8500	7.2938	11.3265	2.9000	3.0560	14.5200	10.4430
Organic,....	4.9000	2.1232	7.3735	2.4400	2.3000	3.9600	2.3004

The Reservoir water is, therefore, superior to the water used for the supply of New-York and Albany, about equal in quality to that of the Passaic river, near Newark, N. J., and little inferior only to the Schuylkill water.

* Analyzed by Prof. Silliman, Jr.

§ Analyzed by Prof. E. M. Horsford.

EXAMINATION OF THE WELL WATERS.

The two wells, the water of which the Board of Health desired me to analyze, are situated, the one at the corner of North Second and Jacob Streets, the other at the corner of Third and Ferry Streets. The water for analysis was taken on the 6th of August, 1857.

The qualitative analyses were conducted in the manner described above for the examination of the Hydrant water.

QUALITATE ANALYSIS OF WATER FROM WELL COR. NORTH SECOND AND JACOB STREETS.

Carbonic acid, silica, sulphuric acid, chlorides, lime, magnesia, alumina with a trace of *sesquioxide of iron, soda.*

Nearly 1000*cc.* of the water were concentrated by evaporation, reduced to about 10*cc.*, and the concentrated solution mixed with a few drops of sulphuric acid and solution of indigo; on applying heat to the mixture, it became decolorized. Another portion of the concentrated water was mixed with an equal volume of concentrated sulphuric acid, and a few drops of a solution of protosulphate of iron added, the liquid assumed a brown color—indicating the presence of *nitric acid.*

QUALITATIVE ANALYSIS OF WATER FROM WELL CORNER THIRD AND FERRY STREETS.

Carbonic acid, silica, sulphuric acid, chlorides, lime, magnesia, alumina with a trace of *sesquioxide of iron, soda.*

This water does not contain nitric acid; and in neither of the two could phosphoric acid be detected.

In determining the quantitative relations of the different ingredients, I pursued essentially the same course as that described above, with this difference that one portion of the water

served for the determination of the silica and bases, another for the determination of the sulphuric acid and chlorine, and a third for the determination of the alkali.

The following results were obtained:

Water from Well corner North Second and Jacob Streets.

Grammes

I. 100*cc.* at 20°C., evaporated to dryness over a water-bath, gave, of total residue,..... 0.0465
The residue upon ignition, lost,..... 0.0107
II. 2000*cc.* at 27°C., gave, of silica,..... 0.0162
" " of carbonate of lime,..... 0.2381
=0.1333 grammes of lime.
2000*cc.* at 27°C., gave of alumina with a trace of sesquioxide of iron,..... 0.0142
" " of phosphate of magnesia,..... 0.0247
=0.009 grammes of magnesia.
III. 1000*cc.* at 27°C, gave, of chloride of silver,..... 0.2932
=0.0725 grammes of chlorine.
" " of sulphate of baryta,..... 0.1025
=0.0352 grammes of sulphuric acid.
IV. 1000*cc.* at 27°C, gave, of chloride of sodium,..... 0.1930
=0.07588 grammes of sodium.

On calculating the several numbers thus obtained for 3785*cc.* =1 gallon of water, reducing them all to an equal temperature. (=27°C.) and converting the grammes into grains, we obtain the following values:

Grains.

Total residue,.....	27.1208
Organic matter and nitric acid,.....	6.2393
Leaving of fixed residue,.....	20.8815
Chlorine,.....	4.2350
Sulphuric acid,.....	2.0558
Silica,.....	0.4723
Alumina with sesquioxide of iron,.....	0.4136
Lime,.....	3.8945
Magnesia,.....	0.2623
Sodium,.....	4.4326

Water from Well corner Third and Ferry Streets.

	Grammes.
I. 100*cc.* at 22°C., evaporated to dryness over a water bath, gave of total residue,.....	0.0483
The residue upon ignition, lost,.....	0.0066
II. 2000*cc.* at 28°C., gave, of silica,.....	0.0172
" " of alumina, with a trace of sesquiox. of iron,.....	0.0019
" " of carbonate of lime,.....	0.3606
=0.2019 grammes of lime.	
" " of phosphate of magnesia,....	0.0449
=0.0163 grammes of magnesia.	
III. 1000*cc.* at 28°C., gave, of chloride of silver,.....	0.2244
=0.0555 grammes of chlorine.	
1000*cc*, at 28°C., gave of sulphate of baryta,.....	0.1477
=0.0507 grammes of sulphuric acid.	
IV. 1000*cc.* at 28°C., gave, of chloride of sodium,.....	0.1975
=0.0078 grammes of sodium.	

The quantities calculated, as above, for one gallon at 28°C., and expressed in grains, we have:

	Grains.
Total residue,.....	28.1259
Organic matter,.....	3.8063
Leaving of fixed residue,.....	24.3196
Chlorine,.....	3.2411
Sulphuric acid,.....	2.9633
Silica,.....	0.5016
Alumina with sesquioxide of iron,.....	0.0554
Lime,.....	5.8869
Magnesia,.....	0.4769
Sodium,.....	4.5329

Grouping the single constituents together according to their relative affinities, on the principle exposed above in the analyses of the Hydrant water, we obtain the following rational expression for the composition of the inorganic residue of the above waters:

	In one gallon = 3785cc. of water from Well cor. N. 2d and Jacob sts.	Well cor 3d and Ferry sts.
	Grains.	*Grains.*
Chloride of sodium,.....	6.2115	3.9459
Carbonate of soda,.....	1.5868*	6.8709§
Chloride of magnesium,.....	0.6230	1.1325
Carbonate of lime,.....	4.3848	6.8082
Sulphate of lime,.....	3.4948	5.0376
Silica,.....	0.4723	0.5016
Alumina with traces of sesquiox. of iron,	0.4136	0.0554
	20.1868	24.3521
Organic matter,.....	6.2393†	3.8063
Total of solid residue,.....	26.4261	28.1584
As determined directly,.....	27.1208	28.1259

The well-water contains, therefore, nearly four times as much solid matter in solution as the hydrant water, and must be considered in every respect inferior to the latter. The difference is more especially perceptible in the amount of soluble chlorides (mixed in one case with nitrates,) and in the large quantity of lime. The following little table, which needs no commentary, will show at a glance the comparative purity of the waters.

Contains, of the following substances, grains in one gallon:	WATER FROM Reservoir.	Pipe, near Hospital.	Well, corner No. 2d and Jacob.	Well, corner 3d & Ferry-sts.
Total residue,.....	7.4376	8.2755	27.1208	28.1259
Organic matter, (and nitric acid,).....	1.4014	2.0000	6.2393	3.8063
Leaving of fixed residue,	6.0362	6.2755	20.8815	24.3196
Chlorine,.....	0.0318	0.0103	4.2350	3.2411
Sulphuric acid,.....	0.4785	0.4615	2.0558	2.9633
Silica,.....	0.3434	0.3358	0.4723	0.5016
Alumina (and phosphate of lime,) with iron,.....	0.1447	0.0922	0.4136	0.0554
Lime,.....	2.5962	2.2895	3.8945	5.8869
Magnesia,.....	0.2762	0.6312	0.2623	0.4769
Sodium,.....	0.2392	0.2469	4.4326	4.5329

*Resulting from the compounds of soda with nitric acid and organic acids.

§Resulting from the compounds of soda with organic acids.

†Sum of organic matter and nitric acid.

All which is respectfully submitted.

WILLIAM ELDERHORST, M. D.,

Professor in the Rensselaer Pol. Institute.

Troy, N. Y., September 14, 1857.

It is no part of my object to glorify the Hydrant water *per se*, though an examination of the preceding very able report of Prof. Elderhorst will show that it is truly "superior to the water used for the supply of New York and Albany, about equal in quality to that of the Passaic river, near Newark, N. J., and only little inferior to the Schuylkill water," and, if the organic matter in its constitution is alone considered, it is superior to most and inferior only to the Schuylkill.

This statement may seem strange to those who think only of the turbid, I had almost said muddy, condition of the water, after rains, or rapid thaws; but it must be borne in mind that the impurities at such times are purely of a mechanical nature, having nothing to do with the chemical constitution of the water, and are easily separated from it by the simplest forms of filtration. These impurities are principally of clay, washed from the road-beds which cross the course of the supply-brook, and can, and doubtless will, be avoided soon by facing the road-beds with stone, thereby preventing the evil, or, which would be the better plan, by taking the water nearer its first source, directly into the iron mains and rejecting the washings of the road sides, barn-yards, and more thickly settled neighborhoods near the reservoir. Admitting to its fullest extent the objectionable character of these impurities, (for the pot-bellied condition of clay eaters in other lands is an all-sufficient proof of the unsymmetrical if not the unhealthful tendencies of such a diet,) it is still contended that the hydrant water is vastly superior, for all purposes, to that derived from any of the city wells.

Its superiority simply as a "soft" water for many domestic purposes admits of no question, and is generally understood; but it is hardly fully appreciated even in this respect. No prudent

house-wife would for a moment think of using the well water to wash with, as she is well aware, that it decomposes a large quantity of soap, before she can produce a lather which is at all serviceable; but she will often prefer it for tea, ignorant of the fact that the large quantities of lime, which make it a hard water for washing, impair its solvent power over the scandal provoking herb to an equal extent. It was calculated in 1850 that by the use of soft water in London the saving in soap would probably be equivalent to the whole of the money at that time expended on water-supply; and the saving in tea would equal one third of the annual consumption. This estimate was doubtless exaggerated; but it sufficiently shows the economical importance of the change. The same difference, in solvent power, extends to its uses in the preparation of soups and broths.

The simple matter of *furring* the vessels in which it is used however trivial it may appear at first sight, or in a single instance, becomes eventualy an important item, and, in the aggregate, a source of material loss. The lime, held in solution in the form of a bicarbonate, parts with a portion of its carbonic acid under the influence of heat, and is precipitated upon the bottom and sides of the vessel, in the form of a carbonate. This, in addition to the inconvenience of rendering the vessel more difficult to cleanse by retaining the odour and flavour of the various substances cooked, is objectionable from its non-conducting power, and causes an increased consumption of fuel. If any one thinks this too small a matter to mention, let him try the experiment of coating the inside of a vessel with a thin shell of plaster of Paris, and he will then find, if never before, reason to believe in the correctness of the old saw, that "a watched pot never boils." Though this increased consumption of heat is in itself no mean ground of objection to these deposits of lime, they are perhaps equally objectionable, by leading to the more rapid destruction of vessels and boilers in which they form. Of such importance was this matter considered, that a few years since the Hudson River Road caused a partial analysis of our hydrant water to be made, before deciding whether to look to that, or some other source for their boiler supply.

Another objection, and the principal one, to this deposition of lime from boiling water, is found in the fact that in cooking,

a large portion of the lime so deposited is left on the surface of the vegetables or meat in the pot, and is hence taken directly into the stomach.

It is not easy in the experience of individuals to show that this is the occasion of disease; but, as water contributes to most of the transformations which occur within the body, it is reasonable to suppose that any constituent, which interferes with its solvent power, will modify materially its effect, not only in the processes of digestion, but in the more subtle, and equally important metamorphoses, which are constantly taking place, by its aid, in every living tissue. Experience establishes the correctness of these views. It is well known to medical men that stone and gravel are vastly more common in lime-stone regions like Kentucky, than in other sections of our country, where softer waters abound; and it is even apparent to the ordinary observer, that persons, in whom afflictions of the kidney are once established are remarkably sensitive to the difference which exists between our hydrant and well waters, in this single element of hardness. Mr. Youat in his well known work on the Horse observes that "hard water drawn fresh from the well will assuredly make the coat of a horse, unaccustomed to it, stare, and it will not unfrequently gripe and otherwise injure him. Instinct, or experience, has made even the horse himself conscious of this; for he will never drink hard water if he has access to soft; he will leave the most transparent and pure (?) water of the well for a river, although the water may be turbid, and even for the muddiest pool." This staring is an effect which Simon says is "analagous to these skin-diseases of the human subject which are apt to occur from the impairment of the digestive functions." Let the ladies take heed.

If the foregoing were the only objections which could be brought against the use of the well water, they would be sufficient, one would think, to lead human beings to imitate the wisdom of the horse; but there are more important differences than the simple one of hardness, differences which, there is reason to believe, have a powerful influence in determining the fearful contrast between the mortality of town and country.

The following table, abstracted from the report of the Registrar General of England for 1853, and derived from the returns of the 10 years 1843-52, will show how great this contrast has become.

IN THE MONTHS OF	AVERAGE ANNUAL NUMBER OF — *Deaths* to every 10,000 persons living in TOWNS.	Deaths to every 10,000 persons living in the COUNTRY.	[illegible]
January, February, March...	69	56	13
April, May, June...........	62	52	10
July, August, September,...	63	46	17
October, Nov., December,...	64	49	15
The Year...............	258	203	55

It is of course not pretended that water is the leading cause of this difference. The occupations of men; the ventilation and drainage of streets and dwellings; the crowded condition of the poor, and the destructive habits which poverty and ignorance and the thousand evil examples of large cities engender—are all elements which go to make up the difference between the mortality of town and country. But there are many facts which tend to prove that the quality of the water consumed is an element of great power.

There is a large class of persons who are of the opinion that they do not need the aid of chemists or doctors to tell them whether the water they have been accustomed to drink for years is wholesome; and who will listen to no arguments calculated to disturb the ignorant prejudices which their own exemption from positive sickness may have fostered. To such, the following facts are submitted as a possible remedy for their mental blindness.

In the Report of the Health Officer of London for the year from September '49 to September '50 is an analysis of water "drawn from the pump near the church in Bishopsgate street, and selected as exemplifying the general composition of the shallow well-water of the city of London, when the well is situated near to a burial-ground, as is frequently the case with the parochial wells."

By an analysis, an imperial gallon of the water gave—

Carbonate of lime,	28.97
" of magnesia,	2.61
Sulphate of lime,	17.85
Chloride of sodium,	16.95
Nitrate of potass,	12.40
" of soda,	1.50
" of magnesia,	4.92
" of ammonia,	4.01
Silica,	0.80
Phosphate of lime,	traces
Organic matter,	
	90.01

"The quantity of alkaline and earthy nitrates in this water is very remarkable. These salts are doubtless derived from the decomposition of animal matter in the adjacent churchyard. Their presence conjoined with the inconsiderable quantity of organic matter which the water contains, illustrates in a very forcible manner the power the earth possesses of depriving the water that percolates it of any animal matter it may hold in solution; and moreover shows in how complete and rapid a manner this process is effected."

"In this case the distance of the well from the church-yard is little more than the breadth of the foot-path, and yet this short extent of intervening ground has, by virtue of the oxidizing power of the earth, been sufficient wholly to decompose and render inoffensive the liquid animal matter that has oozed from the putrifying corpses in the churchyard." We are moreover told that "the water from this well is perfectly bright, clear, and even brilliant; it has an agreeable soft taste, and is much esteemed by the inhabitants of the parish." In the report of the next year Dr. Simon further remarks concerning the same pump water: "You will, perhaps, remember that in my account of one celebrated city pump, which sucks from beneath a church yard, I showed you ninety grains of solid matter in every gallon of its water. In virtue of that wonderful action which earth exerts on organic matter, the former contents of a coffin, here reappear-

ing in a spring, had undergone so complete a change as to be insusceptible to further putrefaction; the grateful coolness, so much admired in the produce of that popular pump, chiefly depending on a proportion of nitre, which arises in the chemical transformation of human remains, and which being dissolved in the water gives it, I believe, some refrigerent taste and slight diuretic action. Undoubtedly this water is an objectionable beverage in respect of its several saline ingredients; but my present object in adverting to them is rather to illustrate an anterior danger which they imply. Their presence indicates a comparitive completion of the putrefactive process, effected by the uniform filtration of organic solutions through a porous soil. *Let that soil have frequent fissures in its substance;* or let its thickness be scanty in proportion to the organic matters to be acted on; and the water, imperfectly filtered, *would run off foul and* PUTRESCENT. Now this risk, more or less, belongs to all pumps within the city of London. They draw from a ground excavated in all directions by sewers, drains, cess-pools, gas-pipes, burial pits. The immense amount of organic matter which infiltrates the soil does undoubtedly, for the greater part, suffer oxidation, and pass into chemical repose, but in any particular case it is the merest chance, whether the glass of water raised to the mouth shall be fraught only with saline results of decomposition—in itself an objectionable issue—or shall contain organic refuse in the active and infectious stage of its earlier transformations. Some recent cutting of a trench, or breakage of a drain in the neighborhood, may have converted a draught which before was chronicaly unwholesome, into one immediately perilous to life. Such facts ought to be known to all persons having custody of pumps within urban districts; and it ought likewise to be known that this infiltrative spoiling of springs may occur to the distance of many hundred yards."

The history of the Bishopgate pump shows the fallacy of popular judgment concerning the value of water when the senses are alone relied on. The nitrate of ammonia present gave an apparent softness to water far harder than any which our city wells contain; and the brilliancy and cool taste and refrigerent effect were due to the unusual amount of carbonic acid gas and nitrates, the direct result of organic decomposition. But I have

not made this long quotation merely to show the fallacy of popular judgment on hygienic or medical questions; the faith which hundreds have in sugar, in water, in the inspiration of seventh sons and of — Thompson, is, to sensible men, abundant proof of this; but the remarks of Dr. Simon are to a great extent as applicable to our city wells as they are to those of London. We have not, it is true, the fat grave-yards as a gathering ground, but we do have nice privies by the hundreds, and three year's familiarity with their whereabouts has satisfied me that they are not injured by any superabundance of sewerage. The public and private wells make the only draughts upon them, and I see no reason why the *debris* resulting from the wear and tear and daily decay of the living body, should furnish material differing much from the final decomposition of the dead. Indeed, I have often queried whether the boasted coolness and undoubted gratefulness of some favorite water, was wholly owing to the depth of the well; or whether it might not have a relation, rather, to the direction from which it came—a relation which the intervening ground would render unsuspected by the senses, unless in times of high water; when an anxiety might be excited for some luckless cat to subside with the unnoted subsidence of the river. Be that as it may, there is no doubt of the surface origin of the chlorides and nitrates of our well waters, and that the contributions from the offal in our alleys and the sinks and privies in our yards, add largely to the bulk of these constituents. There is no doubt also that these constituents, in connection with the large quantities of *lime*, are productive of more important disorders than the calculous diseases before alluded to.

It is in the recollection of our oldest living physicians, and it was a subject of frequent remark by the late revered Dr. Robbins, that affections of the bowels were much more common, particularly among children, before the introduction of the hydrant water, than they have been since its general use. Some of this improvement is doubtless owing to the more frequent use of the bath and sponge, which naturally accompanies the unbounded hydrant supply, and is as naturally neglected when cleanliness is to be obtained only by a visit to, and manual exercise upon, the pump. If any doubt that simple cleanliness has so important an influence on health, let them bear in mind the fact

that even a washed hog will fatten more than a dirty one in the proportion of 5 : 3. When such is the effect upon an organization which instinctively returns to wallowing in the mire, what may reasonably be expected of its importance to those in whom cleanliness is next to godliness?

But we are not dependant on conclusions drawn from loose analogies, for a reason 'for the faith within us.' We have the positive testimony of the same physicians, to the effect that strangers, visiting us, were formerly subjected to attacks of diarrhea, dysentery, and cholera-morbus, as they are now on visiting Canada, or journeying on the Mississippi. We have also the concurrent testimony of physicians in other cities, both in this country and abroad, where the water has presented the same chemical characteristics as our own. Prof. S. H. Douglas, of the University of Michigan, in his report to the Board of Water Commissioners of Detroit, says: "In addition to the above impurities, [chlorides,] the wells of Detroit, *being dug in a clay soil and usually in back yards*, would be liable to contain organic matter in the process of decomposition. This would be particularly the case during the warm season, when sickness is most likely to prevail. The use of water containing this organic matter would predispose to disease, and materially aid in the spread of epidemics. No doubt a careful examination would show that, during the prevalence of the cholera, that disease was most fatal, and prevailed to a greater extent, among those using the water of the wells than among those in the habitual use of the river water." * * * "I have also been informed by Prof. Palmer, of Chicago, that this disease has been observed to be most fatal in that city in those districts where well water was used, although the most high, and apparently the most healthy. The lower districts, containing such quantities of surface water and filth as entirely to preclude the use of well water, were supplied with water from the lake by carts, and were comparatively free from the disease."

I have italicised a portion of the preceding remarks, that the similarity of the conditions to our own, might be noted. The last fact also, is a striking one when coupled with the, now, well settled law, that the lower the level, i. e., the more moist,

(generally,) the greater the mortality. The Professor continues: "Again, the city of Sandusky *is situated on a clay soil, underlaid by a limestone*, and is supplied with water mostly *from wells dug in this tenacious clay.* The water must not only be *highly charged with lime and other earthy salts*, but likewise contain *large quantities of decaying organic matter*, derived from surface drainage. I am fully of the opinion that the fearful ravages of cholera in that city may be, in a great measure, attributed to the use of impure water." "It is a well established fact, that, in the city of Cincinnati, of all persons who used the water of certain springs, during the prevalence of cholera, not one escaped fatal attacks of the disease."

These last quotations suggest the consideration of another great objection to the well-waters, and that is their alarming tendency to aggravate the mortality of epidemic diseases. This effect is after all but the expression of their ordinary influence, acting upon systems under the grasp of some powerful poison, and determining by its aid the issue of the struggle between the contending forces of life and death.

If it were possible to determine accurately their effect in shortening life, by their insidious induction of dyspeptic arrangements, of bowel diseases, and of kidney diseases, and, through these, in laying the foundation for scrofula, consumption and all other constitutional affections, it is doubtful whether it would not be found that the mischief caused by their persistent action in ordinary seasons, is greater than that effected in times of pestilence. But cholera and typhoid fever, in reducing the powers of life to the verge of dissolution make the before unappreciated influence of local causes strikingly apparent, and thus the most skeptical becomes convinced of the effect of dampness, bad ventilation, bad water, defective sewerage and similar insidious excitants of disease.

Some of the foregoing quotations might be appealed to as adequate proof, in themselves, of the pernicious effect of certain kinds of water and, presumptively, of the unhealthy character of our well water, which are shown to chemically resemble them. But knowing the difficulty of removing old impressions, particularly when confirmed by the apparent experience of years, I

submit a few additional facts derived from the Reports of the Registrar General of England for 1853 and 1854, for the loan of which I am indebted to the kindness of Dr. Brinsmade

In the report for 1853 we find the following:

"In Newcastle-upon-Tyne with a population of 89156 in 1851, the mortality from cholera has raised the deaths by all causes from 638 to 2085; in Gateshead from 374 to 771 in three months. The epidemic poison was no sooner introduced into the region than it, as it were, exploded and destroyed nearly 2000 lives.

"In neither of the previous epidemics was any such sudden destruction of life observed. Is the present epidemic—so quickly following the epidemic of 1848-49—of a different and more fatal character? or are there local circumstances, independently of the nature of the epidemic, that account for the desolation that now surrounds Newcastle-upon-Tyne? These important questions can, it is evident, only be definitely answered by careful inquiry into all the circumstances; but enough has been elicited to justify us in refusing to admit at present that the epidemic is in its nature more destructive than its predecessors; while it yields an awful sanction to the hygenic law, which prohibits the use of inferior water."

"The Superintendent Registrars of Newcastle and Gateshead, in reply to inquiries which the Registrar General has made, state, and have forwarded documents showing, that from the 5th of July last, the town which had been supplied before with salubrious water, was supplied largely "from the impure sources of the Tyne, in the vicinity of the sewerage of the town.'"

"The fact cannot be questioned that the water with which Newcastle-upon-Tyne was supplied in 1848-49 was comparatively poor; and that in 1853, when the calamitous loss of life was recorded on the registers, the city was supplied with water containing a strong solution of the contents of the sewers. The same effect was the result of the same cause in Hull in 1849. And other examples may be cited in which the converse happened as at Exeter, when the inhabitants, after having suffered severely from cholera in 1832, obtained purer water, and escaped its ravages in 1848-49."

"The precautions to take against cholera, in regard to *water*, are well stated by Dr. Snow; and they are of so simple a nature that, considering all ths facts, no person can prudently neglect them.

"'Water into which sewers flow, or which is navigated by persons living in boats, *or which is any other way contaminated by the contents of drains or cess-pools, should be entirely disused.*"'

"No person to test the value of such a rule would ever have proposed that a large town which was supplied with good water, and escaped with no considerable loss in a previous epidemic, should on the eve of another epidemic do all that is here forbidden. What no sceptical philosopher would have dared to propose as an experiment, what no haughty conqueror ever condemned the inhabitants of a subjugated city to endure, this fine English town on the Tyne—the centre of the coal trade—of intelligence of every kind, and of engineering knowledge—has done and suffered. All the excreta which are thrown into the streets or water-closets, are washed down the acclivities of the streets into the river; the fermenting mass is driven up and down by the tides, and has thence since July been pumped by the engine at Elswick all over the town through the water pipes for dohestic uses; it has been used for ablution, it has been washed over the floors, it has been drunk as a beverage by many of the children and the wives, as well as large numbers of the higher and middle, as well as the working men of the town. This sad fact in the history of Newcastle will be remembered when the loss of 1500 lives, by which it was followed, is forgotten."

Should it be urged that the foregoing is an extreme case and one from which it is hardly fair to reason when discussing the comparative value of our hydrant and well waters, I remark that analyses shows that the water in question differed from our hydrant water, principally in the same manner as our well water does, and in some respects, not so much, while in none does it but a trifle more.*

From the Report of 1854 I abstract the following items. It appears that to determine the influence of water in the cholera in 1853 a circular was addressed by the Registrar General to the Secretaries of the several Water Companies supplying London, and in the Weekly Return No. 47, November 10, 1853, the general result was thus summed up:

"From the returns received from the Water Companies it appears that cholera finds London, as regards water, in the situation in which it left it. This holds true with reference

*Dr. Robert Dundas Thompson found the Newcastle water "to contain a quantity of organised matter mechanically diffused through it to the amount of 4.502 grs. per gallon. Of this 0.545 grs. was destructible matter; the remaining 3.957 grs. consisted of silicious forms resembling the shields of infusorial animals or diatomaceous plants. Dissolved or finely diffused in the water he further found 2.68 grs. per gallon of organic matter. The water likewise contained 1.18 grs. per gallon of chalk, and 7.3 grs. of muriate and sulphate of soda and sulphate of magnesia. The total solid contents were 15.662 grs. per gallon. This water was, it is said, filtered, but the process is not described by the Water Company.

to all except the Lambeth Waterworks Company, who changed their source of supply nearly two years ago from Lambeth to Thames Ditton; and from a table subjoined it will be seen that the results of the present epidemic in the districts supplied by that Company, as compared with some others, are rather more satisfactory than they were in 1849, an improvement which, it is hoped, in the further course of events will be maintained."

Water Companies.	Sources of supply.	Ag. of Districts supplied chiefly by the respective Companies.		Deaths to 100,000 inhabitants
		Population enumerated 1851.	Deaths from Cholera in 13 weeks ending Nov. 1, 1853	
East London,.....	The river Lee at Lee Bridge,..	434,694	124	29
*Lambeth, of Southwork,.....	The Thames at Thames Ditton, and at Battersea.	346,363	193	56
Southwork, ...	The Thames at Battersea,.....	118,267	100	85
*Southwork, of Kent,.....	The Thames at Battersea,..... The Ravensbourne in Kent, and ditches and *wells*.	17,805	18	101

Part of the table only is given.

"It is believed that through nearly the whole of this Table the impurity of the waters with which the inhabitants of the several districts are supplied is in nearly a direct proportion to the mortality from cholera." * * * * * *

"The influence of the water became more evident; and was discussed in the supplement to the Weekly Return, (Dec. 3d, '53,) from which the following Table is taken."

Part of Table only extracted.

Water Companies.	Sources of supply.	Aggregate of Districts supplied by the respective Companies.		Deaths to 100,000 inhabitants
		Population in 1851.	Deaths from Cholera in 13 weeks ending Nov. 1, 1853	
East London,.....	River Lee at Lee Bridge,.....	434,694	162	37
*Lambeth, of Southwork,.....	The Thames at Thames Ditton, and at Battersea.	346,363	220	64
Southwork, ...	The Thames at Battersea,.....	118,267	121	102
*Southwork, of Kent,.....	The Thames at Battersea,..... The Ravensbourne in Kent, and ditches and *wells*.	17,805	19	107

"After correcting the above Table and the Tables of cholera 1848-9, for the effects of elevation, it is found that a large residual mortality remains, which is fairly referable to the impurity of the water; for it is least where the water is known to be sweetest—greatest where the water is known to be most impure." * * * * * *

*In these cases the same districts are supplied by two different companies.

"The cholera broke out again in 1854, the effects of the bad water were watched during the epidemic; and the general results of a special inquiry are thus described in the Weekly Return, (Oct. 14, 1854.)"

INFLUENCE OF THE WATERS OF LONDON IN THE MORTALITY OF CHOLERA.

"The present epidemic of cholera in London, presents a favorable opportunity for determining the influence of waters of various degrees of impurity, in the mortality of cholera:

"In the report of the epidemic of 1849, the following general results have been obtained."

'"In the six districts which are supplied with water taken from the Thames at Kew, by the Grand Junction, and at Hammersmith, by the West Middlesex, 15 in 10,000 inhabitants died from cholera; and the mortality ranged from 8 to 33."'

'"In the twenty districts supplied by the New River, the East London, and the Kent Companies, with water from springs from the Lee and the Ravensbourne, 48 in 10,000 inhabitants died of cholera, and the mortality ranged from 19 to 96."'

'"In the twelve districts which are supplied with water by the Lambeth, the Chelsea, and the Southwark Companies, from the Thames, between Battersea and Waterloo Bridge, 123 in 10,000 inhabitants died of cholera, and the mortality ranged from 28 to 205."'

'"In the second group of districts, cholera was three times as fatal; in the third, *eight times* as fatal as it was in the first; one, three, and eight, express the relative virulence of the epidemic in the three conditions. The density of the population was greatest in the central group, and nearly the same in the first and third groups."'

"A part of the excessive mortality is referible to the depression of the ground in the twelve districts."

"The Lambeth Company, which, in 1849, took its supply from the Thames at the part where the water is most impure, has, since January 1852, drawn its water from the Thames above the tidal flow, and has thus afforded an opportunity for ascertaining the effects of this great improvement."

"It was observed in the first eruption (1853,) of the present epidemic, that the mortality was diminished in districts which were partially supplied by that Company. (Suplem't to Weekly Return, No. 19, 1853.") [Before quoted.]

"On October, 13, 1853, a circular had been sent to the London Water Companies, and the replies of all except the Lam-

beth Company, showed that their new works and improvements had not then been carried out, as they were only bound, under the act of Parliament, to complete them in 1855, 1856 or 1857."

"The Southwark Company which now supplies the most impure water, stated, however, that though the Act "allowed three years from August, 1852, for the execution of the new works, the contracts for the whole having been made immediately after the passing of the act, and *being now* (October,) *in a rapid course of fulfilment, the works will be completed and in operation one year within the time prescribed*," that is, in September 1854."

"The hopes of the Company, notwithstanding their efforts on the approach of the cholera, were defeated, the officers informed Lord Palmerston, by a concurrence of various causes, and the impure water of the Thames is still supplied by this Company."

"Bermondsey, one of the south districts of London, is exclusively supplied with the impure water, and the deaths by cholera are already more numerous than they were in 1849; while in the parish of Lambeth, which is supplied by the Southwark Company, and partly by the Lambeth Company, the mortality is much lower than it was in 1849."

DEATH FROM CHOLERA.

Districts.	In the year 1849.	In the 14 weeks end'g Oct. 54.
Bermondsey,	734	829
Lambeth,	1,618	904

"But the pipes of the two Companies, which were once in active competition, often run down the same streets, and through the same sub-districts, are supplied with the pure and the impure water."

"Dr. Snow, who has devoted much time to the investigation, having procured from this office the addresses of the persons who died of cholera in Kensington and some other sub-districts, states, as the result of an inquiry from house to house where the pipes of the Lambeth Water Company, are intimately mixed with those of the Southwork Company, that in the seven weeks ending Aug. 25, of 600 deaths from cholera, 475 have happened in houses supplied by the Lambeth Company; 13 in houses supplied by pumps, wells, and springs; 8 in houses which derived their water from the Thames and from ditches."

"The Registrars on the south side of London were instructed to inquire in all cases of death by cholera, whether the house in which the patient was attacked, was supplied by the Southwark, the Lambeth or the Kent Companies, or with water from pumps, wells, ditches or other sources. The inquiry was attended

with difficulty, as the information could not be obtained from Hospitals or Workhouses, and the informants, and the householders themselves were often ignorant of the source of the supply, as the water rate in the worst districts is paid by the landlord. The information was thus not obtained in 766 out of 3805 instances; but it was stated that in 3039 instances, 2284 deaths occurred in houses supplied with the impure Thames water, 294 in houses supplied by the Lambeth Company with the purer filtered water. The disparity was observed week after week in the progress of the epidemic."

"The total number of houses supplied by the Southwark Company is stated to be 40,046; by the Lambeth Company to be 26,107; consequently there were in six weeks, 57 deaths in every 1000 houses supplied with impure water, and 11 in every 1000 supplied with the less impure or comparatively pure water."

Quotations similar to the above, might be multiplied, but I will merely add, that subsequent more extended examinations, made by the Board of Health, fully sustained the conclusions arrived at by the Registrar General.

The foregoing quotations prove clearly, first, that a slight difference in the *degree* of purity in water, where there is even none in *kind*, made a marked difference in the mortality, and it is a very significant fact, secondly, that the assistance of the Kent Company, which received its supplies from the *Ravensbourne, ditches, and* WELLS, was a positive injury to the Southwark Company, (as is seen in the tables,) although the portion of its supplies drawn from the Ravensbourne was doubtless purer than the whole of the water of the Southwark, drawn from the Thames at Battersea.

These pages have been appended to the report of Prof. Elderhorst, in the hope that the facts they embody, may disabuse some well-meaning, but mistaken citizens of the prejudices which cause them to cling so fondly to the old family wells. There are now lying before me four versical calculi, inanimate, but eloquent mementos of the strong attachment to the waters of a favorite well, which was felt by one who in turn taught me to regard them as inferior only to those of the smitten rock. They are also testimonials of years of suffering; and of a life ended before the alloted term, which, without their presence, would still have gladdened the hearts of those who lived it.

We cannot estimate the amount of pain, or number the lessened years, or calculate the proportion of infant deaths, which are strictly due to the steady use of well instead of hydrant water; but we can avoid the occasion of all these; and we may be assured, that the expense incurred will ultimately be borne by the nurse, the druggist and the family physician. The foregoing facts vindicate the wisdom of whatever steps may be taken to improve the condition of the hydrant water, and suggest the propriety of extending its distribution as far and as rapidly as means will permit. They point also to the time when the law will here, as it *does* in England, expect Boards of Health to compel landlords to provide proper water and abundance of it, when procurable, to their tenants, holding, in regard to the rights of property, that "life, too, is a great property;" that while a person takes rent for lodging "he shall not give fever for an equivalent;" and "in his dealings with the ignorant and indefensive poor, cannot be suffered to estimate them at the value of cattle, to associate them in worse than bestial habits, or let them for hire, at however moderate rent, the certain occasions of suffering and death."

WM. P. SEYMOUR,

Health Officer.

Troy, Feb'y 18, 1858.

I take this opportunity of expressing my obligations to George S. Avery, C. E., of Cross River, N. Y., for the loan of a valuable collection of documents on the water supply, sewerage and other sanitary measures of different cities—subjects to which he has devoted particular attention.

W. P. S.